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TITLE: Character string outputting method and apparatus capable of varying sizes of characters

Abstract Text (1):

In a character string outputting apparatus, a character frame is produced by substituting a numeral sequence indicative of an arranging position of each character contained in a desirable character string for a character string configuration function. In this character frame, the respective characters for constituting the desirable character string are allocated within an arbitrary designated character string configuration region. Thus, the fonts for constituting the desirable character string are arranged within the produced character frame, and also the enlarging rate of the respective characters is variable by moving the origins of the fonts about these characters when these fonts are arranged. This character string outputting apparatus may be utilized as such a character string outputting apparatus capable of outputting a proportional spacing font.

US Patent No. (1):5590247Brief Summary Text (9):

To overcome the above-described conventional problem about the character emphasizing method, the Assignee of the present Patent Application has filed one solution method as U.S. patent application Ser. No. 113,835 (filed on Aug. 30, 1993). In this solution method, the character frame used to allocate the respective characters contained in the desirable character string into an arbitrary designated character string configuration region, is determined by substituting the parameters for the character string configuration function. Thus, these characters may be arranged within this predetermined character frame.

Brief Summary Text (10):

Now, a very basic idea of the above-described character string outputting apparatus similarly assigned to this Assignee will be briefly explained with reference to FIG. 8. In FIG. 8, there is schematically shown such a case that 10 characters of "A" to "J" are employed as a desirable character string to be outputted, and two straight lines are entered so as to specify each of the character string arranging regions. In this case, the character string arranging region is specified by such an area which is sandwiched by a straight line P(t) for connecting P(0) to P(10) and a straight line Q(t) for connecting Q(0) to Q(10). These P(t) and Q(t) are called a "character string configuration function". Then, the character frames are determined which are used to specify the arranging region for each of the characters by substituting the suitable parameters for these character string configuration functions P(t) and Q(t).

Brief Summary Text (12):

As described above the coordinate values of the character frames capable of storing the respective characters are calculated by substituting the thus calculated parameters "t" for the character string configuration functions P(t) and Q(t) corresponding to the two straight lines. This character frame corresponds to a rectangle surrounded by the two straight lines in which two sectioning lines for

sectioning the right-sided and left-sided characters are employed as the right and left edges. When the calculation is made of the coordinate values of this character frame, it is required not to establish spaces between the adjoining characters. Then, the respective characters for constituting the character string to be outputted are arranged in such a manner that these characters can be stored within the corresponding character frames.

Brief Summary Text (18):

Even when the parameters would be calculated by accumulating the font body sizes and then the font would be simply stored in the character frames calculated by substituting the resultant parameters for the character string configuration function, the font of the character string could not be correctly represented with keeping the proportional spacing condition. That is, the font body sizes would be compressed as shown in FIG. 11A.

Brief Summary Text (21):

Another object of the present invention is to provide such a character string outputting method/apparatus that while each of character frames is determined which is used when proportional spacing fonts for constituting a desirable character string are allocated into arbitrary designated character string configuration regions, these character frames are defined under such a condition that the desirable character string is proportionally spaced, whereby proportional spacing fonts of the desirable character string can be outputted.

Brief Summary Text (25):

character frame producing means for substituting the numeral sequence calculated by said numeral sequence calculating means for the character string configuration function to produce a coordinate value of a character frame in which said character string is allocated into said character string configuration region;

Brief Summary Text (27):

output means for arranging the respective fonts of the characters constituting said character string within said character frame produced by said character frame producing means, and for outputting said character string proportionally spaced within said character string configuration region.

Brief Summary Text (32):

character frame producing means for substituting said parameter calculated by said parameter calculating means for a character string configuration function, thereby producing a coordinate value of a character frame in which said desirable character string is allocated within said configuration region;

Brief Summary Text (35):

Further, according to another aspect of the present invention, a method for arranging a character string within a preselected character frame area in different magnifications of each character, comprises the steps of:

Brief Summary Text (39):

substituting the calculated numeral sequence for the character string configuration function to produce a coordinate value of a character frame in which said character string is allocated into said character string configuration region;

Brief Summary Text (42):

arranging the respective fonts of the characters constituting said character string within said produced character frame, thereby outputting said character string proportionally spaced within said character string configuration region.

Brief Summary Text (43):

Moreover, according to a further aspect of the present invention, a method for arranging a character string within a preselected character frame area in different font sizes, comprises the steps of:

Brief Summary Text (47):

substituting said calculated parameter for a character string configuration function, thereby producing a coordinate value of a character frame in which said

desirable character string is allocated within said configuration region;

Brief Summary Text (51):

In accordance with the major feature of the present invention, when the respective characters for constituting the desirable character string are allocated into the arbitrary designated character string configuration regions, since the origins of the fonts are moved to their preselected positions to thereby changing the enlarging rates of the characters to be outputted, the dimensions or sizes of the respective characters can be changed. When this featured technique is applied to, for instance, the proportional spacing fonts, the following proportional spacing operation may be carried out. That is, an origin of one character for constituting a desirable character string is moved by a distance defined by a left side bearing of this character, whereby a font size of this character is used as a body size thereof, and this process operation is repeated for the remaining characters contained in this desirable character string. Then, a proper character frame capable of storing therein the proportionally spaced character is so determined that a suitable parameter is calculated based upon both a total value of character widths of the proportional spacing fonts and a character width of each proportional spacing font, and this proper character frame is defined by substituting this parameter for the character string configuration function. As a consequence, even when the proportional spacing font is used, the desirable character string can be allocated into the character string configuration regions with being proportionally spaced. As a result, the proportional spacing fonts of the character string could be outputted with better character balances and natural smoothing conditions.

Drawing Description Text (6):

FIGS. 4A to 4C are schematic illustrations for explaining a basic operation in case that a parameter for a proportional spacing font is calculated to determine a character frame, and a character string to be outputted is allocated into this determined character frame;

Detailed Description Text (5):

The key operation unit 2 is such a key input unit for inputting document data, various commands and so on. When the document data is entered by operating this key operation unit 2, the document data is processed by the main controlling unit 1 and the processed document data is stored into a document memory 3 in the code form. When the memory content of this document memory 3 is read out, the main controlling unit 1 initiates a proportional spacing font calculating unit 4. The function of this proportional spacing font calculating unit 4 is to convert the content of the document 3 into displaying/printing dot patterns. The displaying/printing dot patterns are supplied to a display control unit 5 and a printer control unit 6, thereby being outputted from the display unit 7/printer unit 8.

Detailed Description Text (9):

In FIG. 2, there is shown an internal arrangement of the above-described proportional spacing font calculating unit 4. The proportional spacing font calculating unit 4 is arranged by an outline font memory 4-1, a font body size accumulating section 4-2, a parameter calculating section 4-3, and a character-string-configuration function calculating section 4-4. This proportional spacing font calculating unit 4 further includes a character frame coordinate calculating section 4-5, a font origin coordinate transforming section 4-6, a perspective coordinate transformation calculating section 4-7, a coordinate information buffer 4-8, and an output pattern drawing section 4-9.

Detailed Description Text (11):

The parameter calculating section 4-3 calculates a parameter for each of the characters based upon both the total value derived from the font body size accumulating unit 4-2 and the character width of the respective proportional spacing fonts. The resultant parameters are supplied to the character frame coordinate calculating section 4-5. The character frame coordinate calculating section 4-5 produces such a character frame that the respective characters for constituting the character string to be outputted are allocated and positioned into the previously designated character string arranging regions. To this end, the character frame coordinate is calculated by substituting the parameter for the character string configuration function stored into the character-string-configuration function

memory section 4-4.

Detailed Description Text (12):

The font origin coordinate converting section 4-6 converts the coordinate series within the below-mentioned font body size by parallel-transferring the origin of the proportional spacing font to an upper left position of a font body size about this origin. The necessity of such a coordinate transformation will be described more in detail. Thus, the transformed proportional spacing font is supplied to the perspective coordinate calculating section 4-7. Into this perspective coordinate calculating section 4-7, the coordinate series of the proportional spacing font is entered from the font origin coordinate transforming section 4-6, and furthermore, the character frame coordinate determined by the character frame coordinate calculating section 4-5 is entered. Then, the coordinate transformation of the coordinate series of the proportional font is carried out in the perspective coordinate transformation calculating section 4-7 by employing the known 2-vanishing point perspective method (detailed description thereof being omitted). That is, the perspective coordinate transformation calculating section 4-7 will coordinate-transform a proportional spacing font in order that this proportional spacing font may be stored within the relevant character frame. Thus, the transformed coordinate series is stored in the coordinate information buffer 4-8.

Detailed Description Text (18):

Under these circumstances, the parameter calculating section 4-3 sequentially detects the font body size of a single character from the head character among the character string to be outputted, which has been read out from the outline font memory 4-1, and then adds the detected font body sizes in the width data register (step S4). Subsequently, a parameter "t" is calculated by dividing the total value of the font body sizes (character widths) of the entire character chain by the added value of this width data register by means of the parameter calculating section 4-3. Next, the character frame coordinate calculating section 4-5 produces the character frame coordinate by substituting the parameter "t" calculated by the parameter calculating section 4-3 for the character string configuration function (step S6). It should be noted that the above-described process operation as defined at the step S4 to the step S6 will be repeatedly carried out for each of the characters within the character string to be outputted until all of the characters are detected at the below-mentioned step S10.

Detailed Description Text (22):

As previously described, the resultant parameters are given as follows: t="0.0", "0.45714", "0.62857", and "1.0". The character frame coordinates may be determined by substituting these calculated parameters for the character string configuration function.

Detailed Description Text (28):

Referring back to FIG. 3 the process operation is advanced to a step S7 at which the font origin coordinate transforming section 4-6 transports the origin of the proportional spacing font in the parallel manner so as to transform the coordinate series of the proportional font. In other words, generally speaking, an outline font is represented in the left side of FIG. 6A by such a coordinate series that an upper left corner of the font is assumed as an origin (0.0). When this outline font is processed by the coordinate transformation by employing the 2-vanishing point perspective method, the above-described coordinate series would be transformed into such a coordinate series as illustrated in the right side of FIG. 6A. However, in accordance with this embodiment, as to the proportional spacing font, the character frame is obtained in correspondence with the font body size. As a result, when such a coordinate transformation is carried out that all of the proportional spacing font may be stored within this entire character frame, as illustrated in FIG. 11A, the proportional spacing is not achieved. In other words, when the coordinate transformation would be carried out while maintaining the coordinate series such that the upper left corner of the proportional spacing font is used as the origin in order to store the entire proportional spacing font within the character frame, this coordinate transformation would be effected under such a condition that the portion which is originally overlapped with the adjoining character would be stored into this character frame, resulting in no proportional spacing. As a consequence, the characters would be arranged as if the font body size

were compressed within the character frame.

Detailed Description Text (32):

As previously described in detail, the origin is parallel moved and the font size is made coincident with the body size, whereby the coordinate series of the proportional spacing font becomes that of the font body size, and therefore the proportional spacing font may be conceptionally coincident with the character frame.

Detailed Description Text (35):

As previously described in detail, in accordance with this embodiment, the respective character frames are determined, in which each of the proportional spacing fonts for constituting the desirable character string is allocated within the predetermined character string arranging region. Such character frames that the desirable character string is proportional-spaced and can be stored within the character arranging region are preferably determined to output the proportional spacing font. As a consequence, natural character connections may be realized in the resultant proportional spacing font, and therefore the resultant character series can be outputted with better balance. More specifically, such a specifically designed character string may be outputted even for a proportional spacing font by designating the character string arranging region by the Bezier curve, or the arc and/or by designating such a character string arranging region whose shape is unique.

CLAIMS:

1. A character string outputting apparatus for arranging a character string within a designated region, comprising:

region designating means for designating a character string configuration region so as to arrange the character string within said character string configuration region;

numeral sequence calculating means for expressing said character string configuration region in the form of a character string configuration function and for producing a configuration position of each of characters in the form of a numeral sequence;

character frame producing means for substituting the numeral sequence calculated by said numeral sequence calculating means for the character string configuration function to produce a coordinate value of a character frame in which said character string is allocated into said character string configuration region;

coordinate transforming means for moving a coordinate value of an origin about a font of each character contained in the character string to a predetermined position, and for parallel-moving coordinate data for constituting the fonts of the respective characters in correspondence with moving amounts of the origins; and

output means for arranging the respective fonts of the characters constituting said character string within said character frame produced by said character frame producing means, and for outputting said character string proportionally spaced within said character string configuration region.

5. A character string outputting apparatus for arranging a character string of a proportional spacing font within a designated region, comprising:

region designating means for designating a character string configuration region used to arrange a desirable character string in the form of a character string configuration function;

font body size accumulating means for accumulating a font body size of a proportional spacing font in each of characters which constitute said desirable character string, thereby obtaining a total value of the font body sizes about the entire desirable character string;

parameter calculating means for calculating a parameter for each of said characters contained in said desirable character string based upon both of the total value of the font body sizes of the proportional spacing fonts calculated by said font body size accumulating means, and the font body size of the proportional spacing font about each of said characters;

character frame producing means for substituting said parameter calculated by said parameter calculating means for a character string configuration function, thereby producing a coordinate value of a character frame in which said desirable character string is allocated within said configuration region;

coordinate transforming means for moving an origin of the proportional spacing font to a preselected position with a desirable font body size, whereby a coordinate series within the desirable font body size is coordinate-transformed based on said moved origin, and for making the font size coincident with the desirable font body size; and

output means for arranging said proportional spacing fonts of said respective characters contained in said character chain based on the coordinate series within said font body size, which has been coordinate-transformed by said coordinate transforming means, and for outputting said desirable character string proportionally spaced within said character string configuration region.

8. A method for arranging a character string within a preselected character frame area in different magnifications of each character, comprising the steps of:

designating a character string configuration region so as to arrange the character string within said character string configuration region;

expressing said character string configuration region in the form of a character string configuration function;

producing a configuration position of each of characters in the form of a numeral sequence;

substituting the calculated numeral sequence for the character string configuration function to produce a coordinate value of a character frame in which said character string is allocated into said character string configuration region;

moving a coordinate value of an origin about a font of each character contained in the character string to a predetermined position;

parallel-moving coordinate data for constituting the fonts of the respective characters in correspondence with moving amounts of the origins; and

arranging the respective fonts of the characters constituting said character string within said produced character frame, thereby outputting said character string proportionally spaced within said character string configuration region.

12. A method for arranging a character string within a preselected character frame area in different font sizes, comprising the step of:

designating a character string configuration region used to arrange a desirable character string in the form of a character string configuration function;

accumulating a font body size of a proportional spacing font in each of characters which constitute said desirable character string, thereby obtaining a total value of the font body sizes about the entire desirable character string;

calculating a parameter for each of said characters contained in said desirable character string based upon both of the total value of the font body sizes of the proportional spacing fonts calculated by said font body size accumulating means, and the font body size of the proportional spacing font about each of said characters;

substituting said calculated parameter for a character string configuration

function, thereby producing a coordinate value of a character frame in which said desirable character string is allocated within said configuration region;

moving an origin of the proportional spacing font to a preselected position with a desirable font body size, whereby a coordinate series within the desirable font body size is coordinate-transformed based on said moved origin;

making the font size coincident with the desirable font body size; and

arranging said proportional spacing fonts of said respective characters contained in said character chain based on the coordinate series within said font body size, which has been coordinate-transformed, thereby outputting said desirable character string proportionally spaced within said character string configuration region.